Advancing On-orbit Assembly with ISAR (Intelligent Space Assembly Robot)

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The foundation of our space systems curriculum for the Astro Track students

- Provides midshipmen full-range of hands-on space system development experiences
  - Satellite design
  - Bus and payload development, integration, and testing
  - Mission operation
- Guides students through regulatory and validation procedures
- Educates future naval officers
- Research for future space technologies

Missions:
- Sapphire
- PCSat
- PCSat-2 (ISS)
- ANDE
- MidSTAR
- RAFT/MARScom
- PSAT
- DRAGONsat
- USS Langley
- BRICSat
- QIKCOM-1 (hosted)
- QIKCOM-2 (hosted)
- BRICSat-2
- PSAT-2
- RSat
Vision

• Technological development
• Leverage advantages (cost, mobility, etc...) of small satellites
  • Repairs
  • Diagnostics
• Assembly
  • Perform small, delicate assembly
  • Large structures in space
Steps to reach our vision

1) Demonstrate basic arm movements
2) Add autonomy
3) Demonstrate assembly
4) Improve performance
Steps to reach our vision

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Steps to Reach Our Vision

1) Demonstrate basic arm movements
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4) Improve performance
Add Autonomy - Additional Cameras
Add autonomy - Augmented Feedback Sensors

- Contact
- Proximity
- Strain Gage
- Laser Photogate
Add Autonomy - Arm Motion Planning Algorithm
Demonstrate Assembly
Initial Arm Deployment
Maneuvering for Image Capture
Object Assembly
Steps to Reach Our Vision

1) Demonstrate basic arm movements
2) Add autonomy
3) Demonstrate assembly
4) Improve performance
Demonstrate Assembly

Algorithm → Data
Conclusion

• Expanding on orbit assembly capabilities greatly improves future space mission capabilities

• Autonomous assembly would expand the reach of human missions in space and expand our capabilities on orbit

• ISAR will continue to advance autonomous assembly technology at CubeSat-scale
Thank you. Questions?